Answer all questions   Time: 01 hour

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1. (a) (i) Explain the term 'Ion exchange capacity of a resin.

    [20 marks]

    (ii) Briefly explain, how does ion exchange resin soften water.

    [20 marks]

    (b) Explain what is meant by two dimensional development techniques in TLC.

    [20 marks]

    (c) State Beer-Lambert's law and explain all the terms involved in it.

    [20 marks]

    (d) What is the difference between 'distribution-coefficient' and 'distribution-ratio' in liquid- liquid extraction.

    [20 marks]

2. (a) (i) What is meant by the phrase "Solvent Extraction"? List the advantages of using solvent extraction in the Analytical Chemistry.

    [25 marks]

    (ii) Outline the theory behind in the solvent extraction process

    [30 marks]

    (b) Consider a separation of weak acid (HA) by solvent extraction. Suppose Ka is the ionization constant of weak acid and K_D and D are the partition coefficient (organic/aqueous phase) and distribution ratio respectively. Derive the expression to relate the distribution ratio D with Ka, K_D and $[H^+]$ as indicated below.

    $$D = \frac{K_D}{1 + \frac{Ka}{[H^+]}}$$

    [30 marks]

    (c) List out the four different separation mechanisms in chromatography based on the physical properties of the stationary phase.

    [15 marks]